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The Practical Application and Advantages of Approval Requirements for Gas Ranges

by

R. M. Conner, *Director*
A.G.A. Testing Laboratory[1]

A discussion of some important features of the American Recommended Practice Approval Requirements for Gas Ranges

Records show that definite steps were taken by the gas industry as early as 1903 toward the development of standard specifications for gas ranges. Although the scope of these requirements was somewhat limited, they were gradually expanded and strengthened as progress was made in the science of gas utilization, until 1925, when the present committee on Approval Requirements for Gas Ranges was formed for the purpose of revising the existing standards and placing them in a form adaptable to the existing needs of both the public and the gas industry, and readily capable of enforcement by the then newly created American Gas Association Testing Laboratory.

The underlying purpose of these standards was the improvement of public service through increasing, first of all, the safety of gas ranges and, second, their durability, efficiency, and convenience, and to provide methods of test by which compliance with these standards could be scientifically and accurately determined by the national Testing Laboratory of the American Gas Association.

The first of such Approval Requirements were published early in 1926. These were revised and expanded in 1928 and again in 1929. In 1930 the A.G.A. Approval Requirements Committee, under which all A.G.A. appliance subcommittees function, was so broadened as to function also as a sectional committee of the American Standards Association.[2] During this same year the Subcommittee on Gas Ranges again undertook the revisions of the gas range requirements, which were later approved by the American Standards Association as American Recommended Practice.[3]

The many improvements which have been made in gas ranges, especially during the past two years, coupled with the increased use of liquefied petroleum gases for domestic cooking and heating purposes, necessitated a number of changes and additions to the existing range specifications. Among the more important changes in the 1930 construction requirements appearing in the new code approved in 1932 are those applying to oven and top burner lighters and oven insulation. Most gas range manufacturers now produce appliances with automatic lighter equipment as well as with insulated ovens, consequently comprehensive constructional specifications for such features were deemed essential. The requirements for gas ranges, like those for other types of gas appliances, are minimum standards, and an attempt is made to avoid the inclusion of specifications which will preclude the embodiment of ingenuity of design and improvement. With this in mind, certain other minor changes were made in the construction specifications to permit newly developed features of design and construction where they embody the essential elements of safety, durability, and convenience.

The new code also includes several additional

Name of ASA Bulletin to Be Changed

Beginning with the July issue, Volume 3, No. 7, of the ASA BULLETIN, the name of the publication will be changed to INDUSTRIAL STANDARDIZATION, with the subtitle A MONTHLY REVIEW PUBLISHED BY THE AMERICAN STANDARDS ASSOCIATION. The change has been decided upon in order to indicate, through the name of the publication, the scope of its contents, which covers the field of standardization in general and is not confined to ASA activities.

[1] Cleveland, Ohio.

[2] Sectional Committee on Approval and Installation Requirements for Gas Burning Appliances (Z21).

[3] Approval Requirements for Gas Ranges (Z21a-1932).

performance requirements as well as minor revisions to a number of existing ovens. The gas burning capacity or rating for ovens was reduced from 10,000 Btu per hour to 8000 Btu per hour per cu ft of oven space. This change was made largely for the reason that less heat is required to maintain desired oven temperatures in insulated ovens than was necessary with non-insulated ovens, which formerly were in more general use. A number of performance requirements and test methods applying to top and oven burner lighters, especially those of the automatic type, were added, as well as requirements for safety devices to prevent the escape of unburned gas, oven heating and temperature maintenance tests, temperature of gas cock bodies, requirements and tests for the rust resistance of oven interiors, and for exterior temperatures of oven and broiler tops.

	Type of gas	*Heating value (Btu/cu ft)*	*Specific gravity (Air = 1.0)*	*Air required for complete combustion (Cu ft/cu ft gas)*	*Normal test pressure (Inches H_2O)*
a.	Natural	1135	0.65	10.8	7.0
	Coke oven	535	0.38	4.6	3.5
	Water gas	400	0.70	3.4	3.5
b.	Propane	2500	1.55	23.9	11.0
c.	Butane-air	525	1.16	4.3	5.0

TABLE 1

Characteristics of gases with which ranges are tested

Probably the most important features of the new gas range standards, which were not included in the former requirements, are (1) construction and performance requirements for ranges designed to utilize propane gas, (2) requirements and test methods for propane gas sets, which cover the purity of the propane and the performance characteristics of gas pressure regulators used with such sets, and (3) construction and performance requirements for ranges designed to utilize butane-air gas.

It might be pointed out here that the construction requirements are the same for gas ranges designed to utilize various city gases, propane gas, and butane-air gas, with the following exceptions: (1) Ranges for use with propane gas are required to have fixed orifices, and the name-plate must bear the following additional statement—"This appliance is approved for use only with approved propane gases," (2) Ranges designed to utilize butane-air gas must carry the following additional statement on the name-plate—"This appliance is approved for use only with butane-air gas."

Space will not permit going into detail concerning the numerous requirements in the present gas range code; however, a brief statement concerning some of the performance specifications may be of interest.

For gas ranges designed to use city gas, the performance tests are made with gases having characteristics approximately as shown in Table 1, *a*.

Ranges for use with propane gas are tested for compliance with the performance requirements using approved propane gas which meets with the specifications for such gases; *i.e.*, it must contain at least 95 per cent propane, with the allowable impurities being ethane or butane. The normal test pressure and characteristics of this gas are shown in Table 1, *b*.

The normal test pressure and characteristics of the butane-air gas mixture used in conducting performance tests on ranges designed to utilize butane-air gas are approximately as shown in Table 1, *c*.

The normal gas pressures listed in the table are those at which the respective gases are ordinarily supplied throughout the United States and Canada, but in order to insure proper appliance performance in case the gas pressure may fluctuate up or down from these figures, all ranges are tested and must comply with the requirements not only on each gas at normal pressure at which the adjustments of gas rate and air shutters are made, but also at pressures 50 per cent below and at 25 per cent above normal pressure, without compensating appliance adjustments. Consequently, a degree of flexibility of performance is provided, more than sufficient to compensate for any reasonable pressure variations. Ranges for use with propane gas are tested only at normal pressure, since propane gas sets are provided with gas pressure regulators which are capable of holding the pressure constant at all times.

During tests for compliance with these requirements gas ranges are not connected to a flue pipe but must depend for satisfactory performance solely on the provisions for venting

incorporated in them. This is a more severe condition than the appliance is ordinarily subjected to in the home since in most cases it is connected to a flue.

One of the most important performance requirements applying to gas ranges is the one which specifies that they shall produce no carbon monoxide.

Carbon monoxide is recognized as one of the most dangerous of toxic gases since it is both colorless and odorless and, therefore, cannot be detected by the human senses. This gas may be produced by any carbonaceous material when burned in a limited supply of oxygen or when flames come in contact with a cold surface. The exhaust given off by automobile engines contains a considerable amount of this gas, caused by incomplete combustion of gasoline in the motor. Carbon monoxide may also be produced by the burning of coal, wood, or oil in improper appliances, or under other conditions, where an ample supply of oxygen is not present. In other words, the method of burning the fuel will always have a direct bearing on whether or not its combustion is complete.

The combustion requirements for all types of gas burning appliances are very rigid. In testing a gas range on city gas, for example, the burners are adjusted to consume the proper amount of gas as specified in the requirements. Tests are conducted on both the natural and manufactured gases listed above. A series of three tests is conducted on each type of gas specified, one at normal gas pressure, at which the adjustment of the gas rate and primary air supply is made, and without change in adjustment one at 50 per cent below normal, and one at 25 per cent above normal gas pressure. A gas range which complies with the combustion requirements on the different types of gas, and under the variations in gas pressure used, will operate safely, in so far as the production of carbon monoxide is concerned, when utilized in any part of the United States or Canada if properly installed and adjusted on city gas.

Samples of the products of combustion from the range are analyzed for carbon monoxide on an iodine pentoxide apparatus, which is extremely sensitive. Traces of carbon monoxide as small as 2 parts in 100,000 can be accurately determined by this method under normal operating conditions existing in the Laboratory.

Another performance requirement which is of vital importance from the standpoint of safety is the one which specifies that the temperature on the walls at the sides and back, and on the floor under the range, shall not exceed 90 degrees Fahrenheit above room temperature. This test is conducted with the appliance set 6 inches from the walls of a partial enclosure formed by two walls of 1-inch white pine boards set at right angles and finished in dull black. The floor is constructed of 1-inch white pine flooring covered with one thickness of building paper superimposed by 1-inch tongue-and-groove oak flooring finished in clear varnish. Calibrated thermometers of uniform size having bulbs $^{9}/_{16}$ inch long are inserted through holes in the walls, spaced at 6-inch horizontal and vertical intervals, the bulbs extending beyond the wall and toward the range $^{1}/_{8}$ inch. Thermometers are also placed on the floor under the range with the bulbs 6 inches apart.

With the burners properly adjusted and the range at room temperature the gas at each burner (both top and oven and / or broiler) is ignited and the gas pressure increased to 25 per cent above normal. The test is continued for one hour after the temperature at the center of the oven has reached 550 degrees Fahrenheit. The oven temperature is maintained at this figure during the course of the test. At the end of this period the temperatures as shown by all the thermometers are recorded and compared with room temperature. In case the temperature at any point is more than 90 degrees Fahrenheit above room temperature the range is considered as not meeting this requirement. With a room temperature of 75 degrees Fahrenheit the maximum temperature permissible on the walls and floor would, therefore, be 165 degrees Fahrenheit.

In an investigation to determine the effects of temperature from a fire hazard standpoint, a number of materials commonly used for wall and floor coverings as well as several types of cloth were exposed to various temperatures for a considerable period of time. These materials included white pine wood, heavy cotton cloth, white bond paper, newspaper, oilcloth, painted wood, silk, wool, linen, and muslin. The results showed that the lowest temperature for discoloration or noticeable softening of any of the materials began at approximately 260 degrees Fahrenheit. Of the materials ordinarily used for walls, wall coverings, and floors, oilcloth showed the lowest temperature of discoloration at 290 degrees, but none of them ignited even at a temperature of 500 degrees Fahrenheit. A further investigation indicated that a gas range, which had failed to comply with the fire hazard requirement due to excessive temperatures at two points when set 6 inches from the wall, still had a considerable margin of safety when set 4 inches and 2 inches from the wall, respectively.

Numerous other tests are made on gas ranges to insure their safe performance, durable construction, and convenient and efficient operation.

In order to be approved every gas range must comply in detail with the Requirements for the particular type of gas on which it is to be used. If it fails to conform to any one of the 277 re-

quirements, approval on it is withheld until the necessary changes are made and check tests run to determine its compliance. It might be pointed out in this connection that over 99 per cent of all gas appliances which have been submitted to the Laboratory and tested for approval failed in one or a number of respects and, therefore, had to be changed before approval on them was granted. In a number of cases it was necessary for the manufacturer to virtually rebuild his appliance in order to secure approval.

The gas range requirements are minimum standards for safe operation, satisfactory performance, and reasonably durable construction. They do not preclude the embodiment of ingenuity of design and construction, and are not to be construed as a measure of quality beyond compliance therewith. Beyond these requirements the manufacturer has every conceivable latitute to improve his product and to build appliances which are superior in materials, convenience features, and workmanship to those produced by competing manufacturers.

The American Gas Association approval activities do not stop with the testing and approval of the appliance in the Laboratory but extend into the factory, to the jobbers, and dealers, and in many cases to the customer's premises. Factory inspections of all appliances approved under the Requirements are made at the plants of manufacturers at least once each year to insure maintenance of the type of construction and character of materials and workmanship of all approved products. Every approved appliance is carefully checked against the Laboratory records of the appliance submitted for test. Appliances are completely disassembled and if any detail is found on examination to be contrary to the Laboratory's record of such appliances, a check is made of the stock in the factory to determine whether the same fault is to be found with all such parts. Production models are also inspected when completely assembled to see that all parts are properly located and well fitted, and that bolts are tightly drawn up to insure rigidity. Where features of the appliances are found which do not conform to those of the appliance approved by test, these features are recorded and reported to the manufacturer and he is given the option of returning the appliance for further tests or of changing the construction to conform to the type approved and then re-submit to a subsequent inspection. Otherwise, approval is revoked on such appliances, they are removed from the A.G.A. List of Approved Gas Appliances, and the manufacturer is no longer permitted to display the Laboratory Seal of Approval on such products, until the necessary corrections are made and approval again granted.

In addition to these very rigid factory inspections, check-ups are also made in many cases at the plants of jobbers and dealers, and in some cases on the premises of users of such appliances. From October 1, 1931, to February 1, 1932, Laboratory Inspectors made 190 factory inspections at 169 separate factories located in all sections of the United States and Canada. Seven other factories were also visited during that period where no inspections were made, since they were not in production at the time of the visit. In addition, numerous inspections were made at jobbers' and dealers' places of business in the territories visited. Laboratory inspectors travel approximately 45,000 miles annually for the purpose of checking the products of manufacturers bearing the Laboratory Approval Seal.

When an appliance is found by tests to comply with all of the Requirements, approval is given to the manufacturer on it for the balance of the calendar year, and a Certificate of Approval, bearing a description of the essential features of construction of the appliance or appliances covered, is issued. In order for the manufacturer to secure a renewal of approval for the succeeding year, it is necessary for him to submit to an annual inspection of such appliances at his factory.

To further insure the protection of the public, approval is contingent upon adherence to the Laboratory's policies concerning misleading advertising and misapplication of approval on the part of manufacturers or dealers to unapproved models.

The value of this standardization and approval program to both the gas industry and the public is reflected in (1) the approval of more than 14,500 models of gas ranges alone, (2) the elimination of the necessity for each manufacturer to maintain a large research and testing laboratory, (3) elimination of the necessity for gas companies to set up standards and maintain large testing laboratories, (4) the decrease of waste in manufacturing due to standard specifications, (5) the elimination of a large portion of the inferior ranges from the market, and (6) the creation of good-will for the industry as well as greater safety and satisfaction for the consumer in the use of gas for cooking purposes.

A statement which is typical of the opinion of leading men throughout the gas industry was expressed by the Hon. George B. Cortelyou, president of The Consolidated Gas Company of New York, in an address given in 1931, when he said, "The highest form of service to the public is shown in the operations of the appliance testing laboratory which the Association owns and operates in the City of Cleveland. Through its tests, based on nationally recognized requirements, and the certification of compliance

therewith, the laboratory has immeasureably improved the safety of domestic gas burning appliances and, as a result, has brought about definite and demonstrable improvements in the service rendered to the public."

Standardization of Parts Results in Economies

The economies and conveniences which can be achieved through the standardization of parts, even where the complete unit is not subject to standardization, is demonstrated by the experience of the United States Army with its motor transport system. According to a report in the January 28 issue of *American Machinist*, Colonel Edgar S. Stayer of the Quartermaster Corps, speaking on "Power Plants and Their Relation to the Military Motor Transport of the Army" at the SAE annual meeting, explained that

"the army transport fleet is of a diversification not encountered by any single motor truck company in the world. There is no opportunity to standardize on fewer models or chassis, since studies and experiments over a long period have shown that all are necessary. There has, however, been a definite effort to standardize and to group the vehicles and to obtain interchangeability in these groups.

"Manufacturers have cooperated in this work, particularly in standardization of engines, because manufacturers realized that some sort of standardization must exist in their own products if competition was to be met. As a result, the Corps was offered a series of engines ranging from two to five displacements in a basic design. Crankcases, crankshafts, and camshafts, connecting rods, and about 100 kindred parts were identical throughout each series. Outline dimensions, bell-housing features, and mounting pads were all alike. A series of five engines are interchangeable in a frame mounting, even competitive makes being available to fit the same frame. The series developed maintained a common piston stroke. Cylinder bores served as a basis for increased displacements.

"Purveyors saw fit to follow up this advancement, and this resulted in the development of a series of increased strokes, but mounting dimensions, general outward proportions, and bell-housing features were maintained. This provides direct interchangeability between a series of engines, with some resulting interchangeability between chassis groups, and simplifies the Corps' problem of being able to obtain a larger number of units with exactly similar performance characteristics for such uses as convoy service. It also simplifies the problem of the motor manufacturer and the chassis maker without in any way being derogatory to the versatility of the types of equipment necessary. It permits mass production of the parts in case of extreme need, coupled with a lower cost than would be entailed were each engine individual in type."

Federal Specifications Available from ASA

The following standards have recently been published by the Federal Specifications Board. Copies may be purchased or borrowed through the ASA office:

Ammonium chloride	O-A-491
Batteries, storage; ignition, lighting, and starting	W-B-131
Belting; conveyor	DDD-B-171
Box construction	
Boxes; fiber, corrugated	LLL-B-631
Boxes; fiber, solid	LLL-B-636
Boxes; wood, cleated-plywood construction	NN-B-601
Boxes; wood, nailed and lock-corner	NN-B-621
Boxes; wood, wire-bound	NN-B-631
Cork; compressed	LLL-C-571
Cork; granulated, insulating	HH-C-571
Electrodes; carbon, amorphous	W-E-441
Facings; foundry, carbon-base	SS-F-111
Ferromanganese	QQ-F-161
Fine-aggregate; (for) Portland cement-concrete pavement or base	SS-F-351
Gasoline; motor, United States Government	VV-G-101
Hose and Couplings	
Couplings; hose, garden and water	WW-C-623
Couplings; hose, steam	WW-C-636
Hose; gas	ZZ-H-461
Hose; gasoline, rubber-metal	ZZ-H-466
Hose; pneumatic	ZZ-H-491
Hose; suction, water, smooth-bore	ZZ-H-561
Ink; writing	TT-I-563
Lead; pig	QQ-L-171
Machines; numbering, lever type	GG-M-71
Magnesia; block, pipe-covering (molded)	HH-M-71
Millboard; asbestos	HH-M-351
Mold-wash; silica	SS-M-501
Motor-fuel V	VV-M-571
Mucilage	JJJ-M-791
Packing; rubber, wire-insertion	HH-P-161
Pipe-fittings; brass or bronze (threaded), 125-pound	WW-P-448
Rubber goods: general specifications	ZZ-R-601
Soda ash	O-S-571
Time clock systems, electric	W-T-411
Terneplate (roofing tin)	QQ-T-201
Tubes; automobile and motor-cycle, inner	ZZ-T-721
Wire; brass	QQ-W-321
Wire; fencing, black and galvanized	RR-F-221

How the National Bureau of Standards and ASA Cooperate

A talk on the relations between the National Bureau of Standards and the American Standards Association was delivered before a meeting of the staff of the Bureau on April 15 by Robert A. Martino of the Bureau's Division of Specifications. Mr. Martino has served during the last year as a special liaison representative in the cooperative relations between the Bureau of Standards and the American Standards Association.

Mr. Martino stated that at the present time the Bureau of Standards is responsible for the management of 17 projects, serving either as sole or joint sponsor under the rules of procedure of the American Standards Association. In addition, it is officially represented on 84 sectional and special committees in the development of projects sponsored by other organizations. He said that of the American Standards thus far approved by ASA, the Bureau has participated in the development of 121 relating to many subjects in various fields of industry.

The section of Mr. Martino's talk devoted to Federal Specifications, simplified practice recommendations, and commercial standards will be of special interest to organizations and individuals concerned with projects under the procedure of the American Standards Association. This section follows:

Federal Specifications—Some of the more well recognized and widely used Federal specifications are being submitted to the American Standards Association for consideration for approval as American Standards. From time to time certain Federal specifications promulgated by the Federal Specifications Board which have received widespread approval have been submitted to ASA and several have already received ASA approval. The specification covering dry cells and batteries was approved as an American Standard in 1930, the Bureau serving as sponsor for the sectional committee. Specifications for liquid soap and putty were given the status of American Tentative Standards in 1930 under ASA procedure. The Bureau was officially represented on the special committee which gave consideration to these specifications.

One of the first standards approved by the American Standards Association was that relating to Portland cement, for which there were in existence at that time two specifications, one issued by the American Society for Testing Materials, and the other by the Federal Specifications Board, the two being identical in all respects except for the use of the two words "may" and "shall". The A.S.T.M. specification was formally approved as an American Standard, and thereby the same status was given to the Federal Specification, which covers the identical commodity.

Simplified Practice Recommendations—One of the functions of the Bureau in standardization is the service that it renders to industry in the reduction of waste through the elimination of unnecessary varieties of products, methods, or practices. By means of this cooperation, industry has, through the Bureau's Division of Simplified Practice, established simplified practice recommendations covering many lines of commodities or activities in various fields of industry.

Three simplified practice recommendations dealing with concrete materials and construction, prepared under the auspices of the Division of Simplified Practice, have been submitted for ASA consideration. The Bureau of Standards served as joint sponsor with the Concrete Reinforcing Steel Institute for the ASA sectional committees on steel spiral rods for concrete reinforcement, steel reinforcing bars, and sizes of forms for concrete ribbed floor construction. Recommendations covering the first two subjects were approved as American Standards. These are published by the Bureau of Standards as PR-53 (ASA—A38) and PR-26 (ASA—A47), respectively. The third recommendation is still before the committee, pending acceptance by industry of the proposed revision.

Commercial Standards—Coincident with the work of the Division of Simplified Practice in the elimination of waste and following somewhat in detail the procedure employed in the formulation of simplified practice recommendations, the Bureau's Division of Trade Standards is carrying on a very important activity through its cooperation with industry in the development of commercial standards for grades and standards of quality for different commodities. It frequently happens that different commercial standards in the same broad field may recommend conflicting requirements or methods of test since the procedure for the establishment of these standards provides no direct means for coordination between the various industries, except in so far as each may voluntarily accept the practices of other industries within its own broad field.

In order that this work may be more properly coordinated with similar activities being carried out in various American industries and the value of commercial standards be more generally appreciated; and in order that duplication of work and the promulgation of conflicting standards may be avoided, certain of the commercial standards, at the specific request of the industries concerned, are being submitted to the American Standards Association for approval as American Standards.

At the present time there have been submitted to ASA three commercial standards dealing with builders' template hardware, foundry patterns of wood, and plain and thread plug and ring gage blanks. These have been presented for approval as American Standards by representative organizations of the industries in which they apply. The Bureau of Standards is assisting these organizations in an advisory capacity with reference to matters pertaining to ASA procedure.

British Standards Director Visits United States

A luncheon in honor of Charles le Maistre, secretary of the International Electrotechnical Commission and director of the British Standards Institution, was held on May 11 at the Engineers' Club, New York, by the U. S. National Committee of the IEC, with the cooperation of the American Standards Association.

Mr. le Maistre is spending a few weeks in the United States following a seven months' tour of Australia, New Zealand, and Canada in connection with an effort to bring about closer cooperation between the national standardizing bodies in the British Dominion and with the British Standards Institution (formerly the British Engineering Standards Association).

These cooperative relations are being extensively developed as a result of a resolution adopted at the last British Imperial Conference held in London in 1930,[1] in which it was said:

> "The Conference draws attention to the resolution of the Imperial Conference of 1926 in favor of the adoption, where practicable, of common standards, and recommends that the standardization bodies in the various parts of the British Commonwealth of Nations should keep in regular and systematic consultation with a view to the establishment of uniform standard specifications so far as is practicable in their common interests."

[1] See ASA BULLETIN, May, 1931, page 16, for a more complete discussion of this resolution.

Dr. C. H. Sharp, president of the U. S. National Committee, presided at the luncheon in honor of Mr. le Maistre.

National Directory of Commodity Specifications

An important new volume in the field of standardization has just been published by the U. S. Government Printing Office. This is the 1932 edition of the National Directory of Commodity Specifications.

The new Directory lists standards and specifications for trade associations, technical societies, and organizations that are representative in a national way of some branch of industry, together with standards and specifications prepared by the various governmental agencies. All of the specifications prepared by private corporations, for example, by railroads and public utilities, which were listed in the 1925 edition of the Directory have been omitted from the new edition.

The book includes a statement of the scope of each specification referred to. The decimal system of classification used in the 1925 edition is followed throughout.

The new edition also contains 20 pages of addresses which will prove valuable to persons wishing to obtain copies of the specifications.

All of the specifications listed in the sections relating to wood, paper, coal, petroleum, stone, glass, clay, and other nonmetallic minerals have been printed in full in two volumes previously issued by the National Bureau of Standards. These are "Standards and Specifications in the Wood Using Industries," June, 1927, $1.50 per copy, and "Standards and Specifications for Nonmetallic Minerals and Products," March, 1930, $2.75 per copy.

Copies of the new Directory may be purchased through the ASA office at $1.75 each or from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Books on Standard Language

Two books on Interlingua, a proposed standard international language, are available for loan through the ASA office. The books are *Key to Interlingua* and *Primo Libro de Interlingua.* G. Peano, professor in the Universitate de Torino, Cavoretto, Torino, is the president of the Academia pro Interlingua, which is sponsoring the proposed new language.

Safety Codes—the Basis of Pennsylvania's Progress in Accident Prevention[1]

by

Cyril Ainsworth, *Assistant Secretary*
American Standards Association

A description of the broad program of industrial accident prevention work which has made the State of Pennsylvania a leader in this field

Safety codes, or standards as they are sometimes called, are an absolute necessity in the development of a constructive accident prevention program. This is true from the view-point of the individual plant, of industry as a whole, and from the view-point of the state government. Safety standards are just as valuable to the individual plant, in pointing out ways and means of avoiding accident occurrence, as are time studies in bringing about more efficient production through elimination of waste motion and improper routing of materials and parts. They are just as valuable to an industry as a whole, as a uniform means of improving the general condition of the industry through the elimination of waste due to labor turnover, material spoilage, the lowering of insurance rates, and other forms of savings brought about by elimination of accidents, as is the development of a standard cost accounting system. Safety standards are just as valuable to the state government, in improving the industrial and social life of the state, through pointing out to both employers and employees ways and means of carrying on their daily operations with the maximum efficiency, which can only come through elimination of accidents, as is the uniform school curricula developed to point out to educators the best methods of reaching the maximum efficiency in educating the youth of the state.

Pennsylvania has long been in the lead from all these points of view in accident prevention work. Several of its industrial establishments were among the first in the country to establish accident prevention programs. Some of its industrial associations were among the first to establish programs of education among their members to teach the necessity of eliminating waste through accidents. The state government, through the Department of Factory Inspection, later reorganized as the present Department of Labor and Industry, with broader duties, has been a leader among the states in carrying on a campaign for the prevention of accidents. The development of safety standards, and their application to hazardous conditions in Pennsylvania industries, has been one of the most constructive phases of that campaign.

The development of a safety code program was first initiated by the Department of Labor and Industry in 1914. The Department was organized in 1913 but it was not until the next year that the new department was functioning smoothly enough for it to undertake a new activity of the importance and scope of the safety code program. Fortunately, there were serving on the Industrial Board, and in administrative charge of the affairs of the Department, men and women of unusual breadth of vision who not only saw the value of safety code development to the industries of the state, but who also saw the necessity of carrying on that work under a procedure which was sound by enlisting the complete cooperation of industry. That this cooperation was secured is testified to by the fact that since the inception of the program there has been only one case of an organized attempt to obstruct the completion of a proposed project. This obstruction was only partially successful because the project was completed and has become one of the strongest parts of the safety code program. The procedure for the development of the safety code program was based upon the following:

1. Establishment of the necessity for a particular code, through

(*a*). A study of the reports of accidents sent to the Department;

(*b*). Reports of departmental inspectors concerning conditions in the industry;

(*c*). Information received from outside sources as to causes of accidents occurring outside of Pennsylvania industries but on account of conditions similar to those found in Pennsylvania industries.

[1] Reprinted from the April issue of *Labor and Industry*, published by the Pennsylvania Department of Labor and Industry.

2. The development of the proposed code by a committee composed of representatives of the industries affected

3. Giving industry an opportunity to review the proposed code, before promulgation, through a series of public hearings

4. An opportunity for final objections to be heard by the Industrial Board before final approval is given

From the small beginning made in 1914 to the present time there has been a gradual expansion of the program. Many of the codes adopted in the early days have since been revised and brought up to date. The Department now has on its books many codes recognized as the last word on the subject. It is a program of which Pennsylvania can be proud.

The period of greatest expansion in the program dates from 1921 to the present time. This was chiefly due to the fact that the Department was able to build on the foundation laid in previous years in the development of the procedure, the collection of statistical material and field experience, in such a way as to permit speeding up of the work through the greater cooperation of industry. Industry realized that the Department was endeavoring to be of constructive assistance in the solution of its accident problems, and, in return, gave generously of the time of its engineers through committee and conference work in order that the best possible codes could be developed.

It was during this period of expansion that the Department began, in an enlarged way, its policy of cooperation in the development of uniform safety standards between states. It was in the early days of the history of the Department that the first uniform safety codes in the country were developed. The States of Pennsylvania and New Jersey, through the establishment of joint committees and with the cooperation of the two Departments of Labor and Industry, prepared several safety codes which were adopted and promulgated by both departments. In addition, Pennsylvania was the first state to adopt the first national code to be developed—the A.S.M.E. Boiler Code. The year 1921, however, marked Pennsylvania's entrance into the national program which had been developed and, singularly, the same two states, Pennsylvania and New Jersey, have probably, up until the last year or two, been the greatest supporters of, and have made the greatest use of, the national program.

If a canvass were to be made among representatives of Pennsylvania's industries it would probably be found that very few people realized that many of the safety codes of the Department were national standards developed through national committees using a national experience instead of a local experience. In fact, persons in the Department did not recognize this new phase of its work. The ignorance of the proper facts was not due to a deliberate attempt to hide them but was due to the fact that while the codes were not developed by a strictly Pennsylvania committee, Pennsylvania industries did participate in their development through trade associations, through representation of the Department on the national committees, and through public hearings held throughout the state when adoption was being considered. These national codes contain Pennsylvania experience, Pennsylvania ideas, and Pennsylvania policies. That they have met the needs of Pennsylvania's industries is testified to by the fact that they have been accepted by the industries in the same spirit as prevailed before a national program had been developed. These codes are considered among the strongest in effect in the state and have played an active part in Pennsylvania's accident prevention program. Such codes as those for Power Presses, Foot and Hand Presses; Woodworking Machinery; Use, Care, and Protection of Abrasive Wheels; Head and Eye Protection; and a large part of the Mechanical Power Transmission Apparatus Code are examples of national codes put into effect by Pennsylvania's program.

This activity of Pennsylvania has been recognized as a forward step by other states that are taking up the work. One by one states that have not participated in the national program in the past and states that are undertaking safety code development for the first time are joining in the national movement and their participation is a monument to Pennsylvania leadership.

What is this national movement which Pennsylvania has so ably championed and of which it has become such an important part? This is a natural question to ask and a brief résumé of its history would certainly be in order.

In 1918 the National Safety Council, national insurance organizations, the United States Department of Labor, and the National Bureau of Standards, realizing that there was developing in the country a heterogeneous mass of rules and regulations and specifications no two of which, even on the same subject, seemed to be anywhere near alike, decided to call a conference to discuss ways and means of bringing order out of chaos.

The methods required to be followed in guarding gears, belts, and pulleys in Pennsylvania differed from those required in New Jersey which, in turn, differed from those applied by insurance interests. And again, these could not be brought into harmony with the design of guards furnished with machines by the manufacturer. Surely there could not be so many

correct ways of guarding machinery! If the Pennsylvania requirements were correct, employees in New Jersey were not receiving the proper protection from the hazards. If the insurance requirements were correct, then the guards installed according to the legal requirements of the state were wrong and again improper protection was being afforded. The conference realized that accident prevention work was suffering tremendously because of these conditions and they looked about for a procedure under which an attempt could be made to develop safety codes that would be acceptable to all concerned.

A short time prior to this an organization known as the American Engineering Standards Committee had been organized by several of the national engineering societies to do, in the general engineering field, what the conference we have discussed desired to do in the safety code field. This committee worked under a procedure designed to coordinate the activities of organizations working on similar subjects and to make possible the participation in a project by any group having a substantial interest. The basic principle back of this procedure, but with the national point of view, was identical with that of the several states in organizing committees for the formulation of safety codes, and it seemed as though the procedure lent itself excellently to the development of uniform safety codes.

ASA asked to help

The American Engineering Standards Committee was requested to undertake this work. To do so meant a reorganization of the committee in order that a safety group could be added to the membership. The decision to undertake the work was made and a safety group composed of representatives of the National Safety Council, the national organizations of the stock and mutual insurance companies, and the United States Department of Labor was brought into the membership. A national advisory committee, called the Safety Code Correlating Committee, was also organized to assist in the laying out of the program, correlating the work of the several committees engaged in preparing codes, and giving suggestions regarding the creation of new committees and preparing scopes of new projects. From this beginning the work has progressed until 40 codes have been completed. Fifteen codes are in the process of development. In 1928 the American Engineering Standards Committee was reorganized so as to change it from the committee status to a full-fledged association. It is now known as the American Standards Association.

The American Standards Association is essentially a federation of associations, 43 in number, serving as a clearing house of opinions to the end that a unanimous agreement may be reached in the form of national standards. Such an association is, therefore, in an excellent position to serve as a medium for the development of uniform safety codes. The majority of its membership is composed of organizations representing many industries affected by any state safety code program. In addition, its procedure makes necessary bringing into the work all organizations having a substantial interest, to the end that the standards will have unanimous consent before becoming "American Standards."

In many of the safety code projects which have resulted in the development of American Standard Safety Codes, individual departments of labor or industrial commissions have contributed very largely of their time and experience. In others, the departments have been represented through the two national organizations, the International Association of Industrial Accident Boards and Commissions and the Association of Governmental Officials in Industry. In addition, the project committees have been composed of employers, employees, insurance representatives, manufacturers of equipment, and technical experts. Such a membership brings about a pooling of the points of view of all the principal groups concerned, thereby resulting in a practical and efficient code.

This discussion of Pennsylvania's progress and the national progress in safety code development is of value to the readers in setting forth a picture of a very important phase of accident prevention work. It is equally important to discuss, both from the Pennsylvania and from the national point of view, what this activity means in actual accomplishments and for the future hopes for the program.

Accident prevention work in Pennsylvania would not have reached nearly its present degree of success without the safety code program of the Department of Labor and Industry. It has been the backbone of the movement, although some may claim that it has been succeeded by the educational efforts now being carried on. If one agrees with this latter contention it must be admitted that the educational work could not be a success without the existence of sound safety standards for use in pointing out the most reliable methods of eliminating accident hazards. It is true that even before the passage of the laws creating the Department or providing for workmen's compensation a few individual firms had been carrying on accident prevention work, but the great impetus to the movement in Pennsylvania came with the passage of these laws. The Department was required to enforce the general factory act which had been on the statute books for many years but, to do the job

efficiently, specifications for carrying into effect the provisions of the laws had to be written, and these specifications are what we now call safety codes.

The general factory act

This factory act was written in very general terms. For instance, it stated that all vats, pans, belts, pulleys, gears, and set screws should be guarded. This was an excellent provision as far as it went but it did not go far enough. It did not tell the inspectors, who were obliged to apply the provisions to conditions they found in industrial establishments, how to guard these pieces of apparatus. It did not tell industrial managers under what conditions these pieces of apparatus presented accident hazards; and it did not help in providing ways and means of preventing accidents, similar to those which had already occurred, from occurring in the future. The Department found it necessary to train a new staff of inspectors who had very little knowledge of the fundamental principles of preventing accidents. This condition was in no way a reflection upon the inspectors, because very few people at that time knew much about the subject. It is to be regretted that even today inspectors are being employed who do not have the necessary fundamental knowledge to do the work efficiently. While it may be easier to train the inspector who is employed today than it was the one who was employed in 1913 and 1914, because of a more widespread knowledge of this work, nevertheless if the money that is being wasted year by year in the training of new men (and this amounts to a very considerable sum) could be diverted to constructive accident prevention work, much could be done to reduce the record of 1485 deaths and 109,976 injuries which occurred in Pennsylvania in 1931. An inspector cannot be made out of raw material in a day, month, or year, and much of the blame for the blood that has been spilled through deaths and injuries of Pennsylvania's workers can be attached to the present inefficient system of appointing those employees whose duty it is to endeavor to prevent this spilling of blood. Because, therefore, the Department was faced with these administrative problems, and because it was necessary to give industry some tools with which to work in removing accident hazards, safety codes were prepared as part of the equipment necessary to meet these conditions.

Lest it might be misunderstood that the value of the safety code work applied only to the conditions found in the early days of the accident prevention movement, it should be said that the codes have continued to be of value throughout the years. New inspectors have to be trained; new employees are going into the industries; new processes are being developed which present new accident problems; new establishments are organized; additional industrial managers are becoming safety conscious and desire information with which to attack safety problems. All of these things make it necessary to continue to use safety codes, keep them up to date, and carry the program into new fields.

The use of American Standard Safety Codes has not decreased one particle the value of codes in the work we have just discussed. Undoubtedly they have strengthened this work in that they present a broader point of view obtained from a wider experience than is possible from a purely local point of view. The national codes which Pennsylvania has used, without question, have added strength to the service which the codes perform. An expansion of this idea may serve to point out why such a statement is true.

National codes make possible the purchase of machines equipped at the point of manufacture with built-in guards far more efficient than those superimposed after installation of the machines, and at a greatly reduced cost over that resulting from the installation of guards at a later date by the purchaser of the machines.

Independent safety codes, developed by the several states, make this impossible. In the case of the Safety Code for the Use, Care, and Protection of Abrasive Wheels, we find practically every manufacturer of grinding wheel machinery completely equipping the machines they are now selling with guards required by the code. The code is the "bible" of the industry and new equipment of this type going into Pennsylvania, or any other state, is safe to operate the minute it is installed. This is of particular value to the smaller industries of the state to whom an extensive guarding program becomes prohibitive in cost, thereby lessening their interest in accident prevention work. What is true of abrasive wheels is true of other machinery. The full benefit, in this respect, of national codes can only come through a more widespread use on the part of the states and individual industries.

Value of ASA codes

Again, American Standard Safety Codes adopted by Pennsylvania are of value, particularly to those industries operating in other states, as well as in Pennsylvania, in permitting the development of uniform policies throughout all of the plants of the industry. They permit uniformity of administration of safety work, centralized purchasing of safety devices, with resultant reduced costs and improved relationships with the various departments of labor, because of a more complete understand-

ing of what is required. All of these things cannot help but improve the efficiency of the accident prevention program of those industries.

Another important way in which the uniform safety code program is assisting industry and departments of labor is through improved relationships with insurance companies. These companies, through their national organizations, are assisting in the development of the codes and have agreed upon a policy which is bringing the national compensation rating schedule into complete harmony with the American Standard Safety Codes. The policy is about 90 per cent effective at the present time. These improved relationships do not at this time affect the Pennsylvania situation, for the reason that the insurance companies doing business in Pennsylvania do not use the national schedule but use one prepared by the Pennsylvania Compensation Rating and Inspection Bureau. There are many differences between the Pennsylvania schedule and the safety code of the Department, and the administration of these very often presents difficulties to the industrial executive because of the fact that he received conflicting instructions from state and insurance authorities. Much has been done to eliminate these differences, but those that remain will continue to hinder accident prevention work in Pennsylvania. The continued use by the Department of national codes and the continued policy of eliminating differences between the Pennsylvania insurance schedule and Department codes will gradually bring about complete harmony between Pennsylvania and national insurance schedules which will greatly simplify matters for all concerned.

There is one additional value of national codes, from a nation-wide point of view, to the accident prevention movement in general. This lies in the assistance given to those states whose budgets do not make it possible for them to enter into such an extensive program as that carried on by Pennsylvania. Accident prevention work in such states has been considerably retarded because of the lack of funds. Some of these states have been able to take the national codes, train their inspectors in their application, and give to the industries in those states definite advice and help in solving their safety problems. Without such codes, accident prevention work in these states would have been considerably delayed.

It would be quite possible, if space would permit, to continue to set forth the value of these safety code programs to the accident prevention movement from both the national and Pennsylvania points of view. The Pennsylvania Department of Labor and Industry and the industries of the state, including both the employers and the employees, are deserving of the highest commendation for the efficiency of the safety code program which they have cooperated in developing. They are to be thanked for their excellent contribution to the national movement and for the stimulus which that contribution has given to accident prevention in general.

Certification by Austrian Standardizing Body

Sparwirtschaft, the monthly publication of the Austrian national standardizing body, contains the following announcement in the February, 1932, issue:

"For the purpose of identifying products complying with the standard specifications and in this way to guarantee the purchaser compliance with the standards, the Austrian body has obtained a copyright on the Association mark in accordance with [here follows mention of the Austrian laws concerned].

"The right to use this mark on standard products is to be applied for to the Austrian body in each special case, and proof brought that the products concerned are in accordance with the standards.

"The grant of the right to use the mark is subject to a charge of 10 Austrian shillings per item, to be paid at once. Illegal use of the mark, that is, its use without approval of the Austrian body or its use on products that are not in accordance with the standards, will be prosecuted."

Standardization Work of the Detroit Edison Company

Because of the wide interest in the articles on the standardization work of the Detroit Edison Company by F. M. Price, assistant editor of the *Standards Catalog*, Detroit Edison Company, which appeared in three sections in the February, March, and April issues of the ASA BULLETIN, this article has been reprinted and copies of the reprint are now available without charge from the ASA office. The article is probably the most complete description which has yet appeared in print of the methods used in placing the purchases of a large company on a standardized basis. The need for such standardization, the organization of the work, the preparation of the necessary records, and the results accomplished are all clearly treated in the article.

Actions of Electrotechnical Commission on Names for Metric Magnetic Units

by

A. E. Kennelly,[1] *Honorary Secretary*
United States National Committee
International Electrotechnical Commission

Notes on actions taken by the International Electrotechnical Commission in various matters between 1927 and 1931

The International Electrotechnical Commission has devoted attention for several years to the nomenclature and definitions of the magnetic-circuit C.G.S. units, as used in electrical engineering literature. The I.E.C. organization includes a number of international Advisory Committees, each dealing with a special subject. Units and magnitudes are dealt with by Section B of Advisory Committee 1 on Nomenclature. This article aims to present an unofficial outline of the actions taken by the I.E.C. and its committees up to the present date, so far as concerns C.G.S. magnetic units. The official minutes of the various meetings are obtainable by application to the secretary of the U. S. National Committee of the International Electrochemical Commission.[2]

Action at the I.E.C. Plenary Meeting of 1927

At the I.E.C. meeting of 1927, in Bellagio, Italy, a proposal was introduced by the Italian National Committee to adopt a unit of magnetic flux Φ in the *practical* or *volt-ampere-ohm* system of units. The proposal was referred, for discussion and report, to a special international committee of seven members, representing seven countries. This committee was unable to reach agreement; but recommended that the whole question of magnetic units should be studied by all the National Committees, and should be discussed at the next I.E.C. Plenary Meeting, set for 1930, in Scandinavia. Communications and discussions were exchanged for that purpose. Examination of electrotechnical literature showed that, since the actions of the Paris Congress of 1900, there has been much misunderstanding in the use of the C.G.S. magnetic units, not merely in one country but throughout the world. Some writers had used the name *gauss* for the C.G.S. unit of magnetizing force H, others for the C.G.S. unit of flux density B, and yet others for both H and B indiscriminately. In order to secure uniformity of usage, an international redefinition of the meanings attached to the unit quantities of H and B appeared to be necessary.

Actions at the I.E.C. meetings in Scandinavia, June–July, 1930

The I.E.C. Committee on Magnetic Units met in Copenhagen and Stockholm. It was able to reach agreement on the main questions involved. Its membership was increased to include twelve countries, and its name was changed to Section B of Advisory Committee 1 (Nomenclature) on Electric and Magnetic Magnitudes and Units (E.M.M.U.).

The E.M.M.U. Committee agreed unanimously on the convention that magnetic flux density B and magnetizing force H, in vacuo or free space, have different physical dimensions; so that their ratio μ_0, the *space permeability*, is a dimensional quantity, and not the mere numeric unity in the C.G.S. system. It was also unanimously agreed that the ratio μ/μ_0 of the absolute permeability of a magnetic substance, such as steel, to the space permeability, should be called its *relative permeability* and should be taken as a mere numeric. Consequently, when we speak of steel, at a certain magnetizing force, having an *absolute permeability* μ, of, say, 1000 units, this is a dimensional quantity of the same dimensions as the *space permeability* μ_0; but if we speak of its relative permeability μ/μ_0, as being 1000, we refer to a mere numeric.

The permeability convention having thus been decided, the E.M.M.U. Committee adopted the following names for C.G.S. mag-

[1] Professor Emeritus of Electrical Engineering, Harvard University, Cambridge, Mass.

[2] P. G. Agnew, secretary, American Standards Association, 29 West 39 Street, New York.

netic units, either unanimously, or by a large majority:

For the C.G.S. Magnetic Unit of:

Magnetomotive force (force magnétomotrice) F the name *gilbert*

Magnetizing force (champ magnétique) H the name *oersted*

Magnetic flux (flux d'induction magnétique) Φ the name *maxwell*

Flux density (induction magnétique) B the name *gauss*

The name *maxwell* had already been adopted at Paris, in 1900, with the same meaning as above.

The name *oersted* had been used in America for the C.G.S. unit of reluctance R, but had never been adopted internationally. It was transferred to the unit of H, on the proposal of the Danish Committee, partly because Oersted's discovery in 1920 related to H, and not to R, and partly to indicate that the name *gauss* should be inapplicable to H, after being assigned to B, on account of their accepted differences in dimensions.

It was also agreed to adopt the *practical* unit of magnetic flux with the value of 10^8 *maxwells*, and with the name *pramaxwell.*

The above-mentioned actions of the committee were endorsed by the Advisory Committee 1 on Nomenclature, and were reported to the Plenary Meeting at Oslo, where they were unanimously approved on July 9, 1930. (I.E.C. Document No. R. M. 77/).

Actions subsequent to the Oslo Meeting of 1930

Some objections to the I.E.C. actions in Scandinavia appeared in technical journals of 1930–31. In view of these differences of opinion, it was decided to hold a special meeting of the E.M.M.U. Committee at London, in September, 1931, to review the actions taken at Stockholm and Oslo.

At the London meeting of the E.M.M.U. Committee, the National Committees of ten countries were represented. It was agreed unanimously (two countries abstaining) that the C.G.S. magnetic units and their accepted names, as fixed at the Oslo Plenary Meeting should remain undisturbed.

Conclusions

In regard to the C.G.S. magnetic units, the I.E.C. international convention secured at Oslo, in 1930, adopting the *gilbert*, *oersted*, *maxwell*, and *gauss*, have been ratified by the E.M.M.U. meeting at London, in 1931. If these conventions are generally adopted, the thirty-year confusion and ambiguity of terms in magnetic literature should disappear.

A.S.T.M. Will Hold Annual Meeting

During the week of June 20, the American Society for Testing Materials will hold its annual meeting in Atlantic City. In addition to reports of many committees, a Symposium on Steel Castings under the auspices of the A.S.T.M. and the American Foundrymen's Association will be held. This Symposium is scheduled for the afternoon and evening of Tuesday, June 21. The Symposium, the second in a series planned by the joint sponsors for the purpose of securing and publishing critical data on the engineering properties of castings, will follow somewhat similar lines to the Symposium on Malleable Iron Castings held at the 1931 A.S.T.M. annual meeting, which aroused wide interest.

The Edgar Marburg Lecture, a feature of recent meetings of the Society, will be delivered on Wednesday, June 22, by Professor Hugh Scott Taylor, chairman of the Chemistry Department at Princeton. His subject will be "Fundamentals in the Problem of Resistance to Deterioration."

A.S.T.M. Publishes Index to Proceedings

The American Society for Testing Materials recently published an index to its *Proceedings*, Volumes 26–30, 1926–1930. Complete subject and author indexes are included. The publication should be of particular service to any one interested in ascertaining quickly the progress of standardization and research problems under the supervision of the many A.S.T.M. Committees.

The *Index to Proceedings* may be purchased from the American Standards Association, or from the A.S.T.M., 1315 Spruce Street, Philadelphia, at $2.50 for the cloth-bound volume, or $3.50 for the volume bound in half-leather. A copy is also available for loan from the ASA office.

Boyd Chairman of Committee on Petroleum Products and Lubricants

T. A. Boyd, Research Laboratory, General Motors Corporation, Detroit, has succeeded F. A. Hull, deceased, as chairman of the Sectional Committee on Petroleum Products and Lubricants (Z11).

The Importance of Standardization in the Welding Industry

The following is an abstract from a paper presented before the Pittsburgh Section of the American Welding Society by C. G. Watson, general manager of the Youngstown Welding and Engineering Company, Youngstown, Ohio, and published in Welding, January, 1932.

Welding has grown to be a very important factor in industry. The time has arrived when we must establish some very definite standards, rules, and ethics. We must set down clearly the principles by which one may specify, purchase, and judge welded products, and eliminate the uncertainty now felt when considering welding. The future of welding in industry depends upon the amount of confidence we build up in it.

To standardize welding means that we must classify the welding field and establish a very definite and uniform meaning for each term. We must define each weld as to class, name, and strength.

The classification of a weld is generally accepted as settled. Under it we have the resistance process including spot welding, butt welding, and flash welding; the fusion process including oxy-acetylene, atomic hydrogen, metallic arc, carbon arc; the thermit process; and the hammer and forge processes. However, there is need of sub-classifications under these general classifications.

The names now in use may mean almost anything. However, a butt weld should be a butt weld whether it is made by the resistance process, the fusion process, or any other. The use of the term "lap weld" should not be confused. Corner welds, tee welds, fillet welds, vee welds, double vee welds, single welds, double welds, stitch welds, tack welds, continuous welds, and so on indefinitely need to be clearly defined.

The meaning of "tensile strength" was pretty generally accepted for years until it began to be applied to a welding joint. Why use "tensile strength" when we mean ultimate strength? We should return to the accepted meaning of "tensile strength." "Shear" and "elongation" are terms that should not be abused or new meanings applied. The resistance to shock or fatigue is a comparatively new quality of strength in welds and should be definitely defined.

The big question that arises is: Can this be done? The steel producing industry is standardized. You may order without hesitancy a plate of fire-box steel quality. The steel fabricating industry is standardized. You may order a bridge or a building and have definite standards to judge it by. The foundry industry is standardized. The electrical industry, the textile industry, and others are practically all standardized.

We believe that it would be easy and practical to establish a code covering welded buildings and structures, a code covering boilers and pressure tanks, a code covering storage and general plate construction, piping and pipe line construction, and general machine part construction. We know from experience those things that are acceptable and those that are not, and it should be an easy matter to put them down in a logical and systematic manner whereby those that are not as familiar with welding as some of us can be guided and benefited by our experiences.

In building construction we have tested various types of joints until it is no longer a matter of guess. There are as definite methods of figuring the strength of a joint as there are in other types of construction. We know that in welded buildings a certain class of structural steel should be used, that a certain grade of electrode should be used, that in order to produce a certain amount of strength we must have welds of certain dimensions made under certain conditions by qualified welders. We further know that if they are made according to the prescribed procedure that their ultimate strength will not be under a certain figure. We know what factor of safety we wish to use. The same principles apply to boilers, tanks, pipe lines, etc. . . . .

Progress toward standardization

In discussing standardization the question naturally arises—What has been done? and it can be answered by saying—Much. However, the effort has lacked uniformity of purpose and a centralized control.

Our American Welding Society has published enough good material on welding methods, processes, requirements, and tests to convince almost any one that there is very little doubt as to the reliability of welding or the possibilities of a standard code.

The A.S.M.E. has published specifications for welding. They have a good-sized booklet

covering the requirements for riveted construction of their unfired pressure vessels, yet they are able to cover welded construction in five pages. We are very positive that a very unsatisfactory pressure vessel could be built to meet the requirements of their code and that a very satisfactory pressure vessel could be built which would not pass the first requirements.

The Hartford Steam Boiler Inspection have done and are doing some very wonderful work. They are attacking the problem from a logical and sane standpoint. Their big requirement is the finished product rather than how it is arrived at. If you have a new method or different method that will produce the required strength and physical properties you will have very little trouble in getting a Hartford inspector to pass your work. In their laboratories and in the field they have made some very thorough investigations of welding and of welded products. We can look forward to the day that they will have as definite a code covering welded work as they now have covering riveted construction.

The manufacturers of equipment have at various times published much good and bad information concerning our problems of welding. We believe that they have done themselves and the industry at times a great deal of injustice by lack of cooperation, and failure to see that the big problem was the building up of confidence in the product rather than some immaterial detail of method.

The state boiler codes of the various states touch more or less upon welding, principally less. Some of the codes are as antiquated as sailing vessels. You who are familiar with welding will find very interesting reading on the subject in some of our state boiler codes as well as in some of the various building codes over the country. . . .

Benefits of standardization

By standardization and a standard code we may hope to establish a confidence in welding and welded products, to remove the doubt and uncertainty as to what one will receive or may hope to receive by specifying welding, to tear down the barrier that now stands across our path and have welding permitted where it is now barred, to furnish to our customers a standard and uniform means of specifying and judging our products, to increase the amount of welding manyfold, to improve the general quality of the work, to improve the general conditions by the elimination of unscrupulous competition, and to establish welding in its proper place in industry.

In order to accomplish the work of standardization in an efficient and capable manner we must compromise the views and the opinions of the architect, the engineer, the builder, the welder, the manufacturer of welding equipment, the manufacturer of raw materials, and the consumer. By bringing together the different view-points we should be able to get a workable and practical code.

By taking advantage of the experience gained in the various projects that have been successfully completed, the task will not be nearly as difficult as it might at first seem. It should be easy to secure the cooperation of the various engineering and technical societies, but in order successfully to complete the work of standardization it will be necessary for some organization to give it its unqualified backing.

There is no one in a better position to take up this work and follow it through than our own American Welding Society.

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German Standard on Welding Practice

Welded steel structures have been studied in Germany by a representative committee from the Verein Deutscher Ingenieure since 1929. This committee published a draft of rules for construction of steel buildings early in 1930. A larger committee, including representatives of the German Railway Company, was then appointed to draw up specifications to include bridges as well as other types of welded structures. A provisional specification was published for criticism and was followed by the standard itself, DIN 4100, in May, 1931. Included in the specification are requirements for regular checking of the operators' skill by means of test welds which are then loaded to destruction in testing machines. Processes provided for include welding by electric arc, resistance, gas, or gas-electric. Rules are given for determining the strength of welded joints as well as definite directions for setting forth maximum allowable stresses in reinforced and unreinforced joints.

This development of standard practice for welded steel structures is of particular interest in view of recent announcements in technical journals of the construction of frameless steel houses by electric welding in different sections of the United States. It is proposed to fabricate frameless steel houses by welding sheets which have been rolled by a continuous sheet-rolling process and shaped at the mill. Modern insulating materials will be extensively utilized in the construction of the steel houses.

Copies of the new German standard, DIN 4100, are available for loan or purchase at 15 cents each from the American Standards Association.

Short Courses in Standardization for Soviet Russia

by

I. Gutmann[1]

In her review of the standardization program of Soviet Russia for the year 1932, published in the January issue of the ASA BULLETIN, the author, R. Dubravaskaya, stated that "The standardization program of 1932 will be handicapped principally through the absence of a staff of suitably trained organizers of standardization work. The plan, therefore, must provide for the training of standardization workers."

In an article headed "Standardization Staffs" in *Vestnik Standartizatziyi*, M. Grigorovich considered this very problem and offered a temporary solution in the form of a series of short courses in standardization practice especially adapted to the needs of engineers of various degrees and kinds of preparatory technical training. The lack of qualified standardization workers is, so to speak, the "bottleneck" of the standardization movement in Russia.

Mr. Grigorovich presents detailed curricula of several types of short courses. Following is the curriculum of a typical course, the short course in standardization for engineers in the machine construction industry:

	Title of Subject	*Hours*
1.	Plan of development of the machinery industry and problems of socialistic industrialization in U.S.S.R.	10
2.	Recent progress in the machine construction industry	12
3.	Principles of socialistic standardization	10
4.	Introduction of the metric system	6
5.	Standardization methods in the metals industry	20
6.	Standardization of factory drafting room practices	8
7.	Standards for ferrous and non-ferrous metals	24
8.	Machinery tolerances	20
9.	Machine tool standards	10
10.	Jigs and fixtures	10
11.	Semi-fabrication standards (forging, casting, and modeling)	10
12.	Equipment standards, including fittings, piping, etc.	10
13.	Woodworking standards	6
14.	Methods of computing effectiveness of standardization	10
15.	Organization of standardization work in plants and industries and introduction of manufacturing standards	16
	Total	182

Classroom instruction is to be supplemented with practical work and excursions.

Some of the 15 items of this curriculum are worked out in detailed "programs" with extensive explanatory notes, bibliography, etc. The following abridged "program" of item 7 of the general "curriculum" is an example:

	Title of Subject	*Hours*
A.	General characterization of the standards of ferrous and non-ferrous metals used in machine construction and of the factors determining their shaping. Geometry of products and semi-products, qualitative properties, testing methods, technical rules	2
B.	Lists of ingots for ferrous and non-ferrous metals. Geometry of standard blooms, wire bars, etc. Discussion of examples taken from official Russian standards	2
C.	Lists of rolled ferrous and non-ferrous metals not intended for any specific use. Structural shapes, strap metal, and plate metal. Factors determining design of standard shapes. Gradation of sizes and precision standards. Discussion of examples taken from official Russian standards	2
D.	Lists of rolled ferrous and non-ferrous metals for strictly specific uses, such as shapes for agricultural machinery. Design of standards to suit specialized	

[1] Associate Editor, Engineering Index, New York, N. Y.

	manufactures. Economies of special shapes. Analysis and discussion of Russian official standards for special shapes	2
E.	Drawn metal for specific and non-specific uses. Ferrous and non-ferrous wire and bars. Discussion of Russian official standards	2
F.	Pipes and tubing, cast, rolled, drawn, and welded. Relation between standards for piping and for fittings. Special group of tube standards for aircraft, petroleum industry, locomotive construction, etc. International work on pipe standardization	2
G.	Iron and steel, classification and specifications:	
	1. South-Russian and Ural cast irons	1
	2. Ferrous rolled materials for non-specific uses	2
	3. Special types of rolled products: plate iron and sheet iron	1
	4. Special steels, classification and specifications	1
H.	Non-ferrous metals, classification and specifications. Classification of copper, zinc, tin, aluminum, antimony, copper, zinc alloys, etc. Specifications for these materials and their alloys	3
I.	Specifications for testing and for methods of analyses:	
	1. Technical sampling	1
	2. Bending, tension, and compression tests	2
	3. Brinell and Rockwell hardness tests	2
	4. Macroscopic and microscopic investigations	1
	5. Chemical analysis of ferrous and non-ferrous metals	1
	Total	27

Similar detail programs for short-course instruction have also been worked out to suit the special needs of institutes of mining and metallurgy.

It has been urged that the curricula of all technical schools should be revised for the purpose of including standardization instruction in one form or another. It is not expected that the technical schools and colleges of the country will ever turn out full-fledged standardization experts—experts will be made in the factories—but it is expected that graduates of technical schools should come to the factories equipped with a general knowledge of standardization methods and techniques.

From this point of view, the plan for centralized short-course instruction in standardization is admittedly only a temporary palliative, which, though indispensable at the moment, is far from offering a radical solution.

Coal Mining Standardization in Great Britain

Standardization in the coal mining fields of Great Britain is under the direction of the Colliery Engineering Industry Committee, organized by the Engineering Divisional Council of the British Standards Institution. Standardization in the mining field, originally initiated in 1923, has resulted in the development of 22 specifications, of which about 20,000 copies have been sold since 1926.

The development of standards in the coal mining industry is carried on by the following eight technical committees, assisted by regional committees acting in an advisory capacity in the various fields: materials, steel arches, colliery wire ropes; light rails; mining electrical plant; underground conveyor troughing; colliery tub (car) wheels; capping metal for wire ropes.

Belting Standards Changed

The American Leather Belting Association announces that for the greater protection of the consumers of leather belting this commodity will henceforth be sold by specifications of thickness instead of weight, thereby discarding the old weight terminology of "ounces per square foot," which may be varied by the mere addition of weighting materials to the leather and does not necessarily always represent a differential in transmission values. The decision to do this was reached after the association had canvassed all manufacturers of belting throughout the country. The movement can, it is said, be considered as having the endorsement of the entire industry.

This is an interesting and progressive move, in the opinion of the association, for the purpose of establishing higher standards for a product that has been sold by weight for many years. Inasmuch as leather belting prices are based on thickness, the simplicity and common sense of this change has met with the instant approval of both manufacturers and users of leather belting. It simplifies and makes comparatively easy the checking of each piece of belting to see if the average thickness is as ordered.—*Reprinted from Electrical World, March 19, 1932.*

Standardization of Textile Machinery in Germany to Prevent Waste

by

F. J. Schlink[1]

German manufacturers find that great economies can be achieved by establishing standards for parts requiring frequent replacement

The subject of standardization of textile machinery is one of particular interest in Germany at this time. A special trade standards committee of the German national standardizing body has been set up, in which associations active in textile manufacturing and in the manufacture of textile machinery have joined forces to establish a clearing-house for this particular field of standardization. This committee has so far published 87 definitive standard sheets, and many draft standards. A few typical projects are: diameter of shafts and bolts for looms; alternating current motors, dimensions of surfaces for attachment to machines; filling forks for light looms; warp beams for looms; ratchet wheels for power looms—general design sheet; shuttles, outside dimensions.

The standards deal mainly with parts of textile machinery which are subject to rapid wear, or which must be replaced from time to time for other reasons (such, for example, as a change to the manufacture of a different kind of product) and which, therefore, make it desirable to secure interchangeability. In this kind of German standardization work the greatest progress has been made with regard to the design of looms, as the looms used in Germany are mostly of German manufacture, so that agreement on the standards is relatively simple. In the field of spinning machines, in respect to which the need of standardization is just as great as in the case of looms, the situation is more difficult, as in Germany a large number of foreign-built spinning machines—and among these a great many of American make—are used. The interest in these machines would probably increase if the German textile industry were in a position to obtain replacement parts and component parts from German manufacturers. However, this would be possible only if standards for these parts were set up in cooperation with the American textile machinery industry. Standard screw threads, for instance, are needed in connection with the spindles. There are now three different threads: one with a diameter of one inch, with 16 threads to the inch; a 25-mm metric thread; and one, less often used, of 22 mm.

Another item which it is intended to standardize is the height of the spindle driving pulley, which height, according to German opinion, should be definite and subject to no variations greater than one, or possibly two, millimeters, plus or minus. The spindle design will be completely standardized in Germany, at least in its essential elements.

Another field of German standardization work which touches upon American interests is the standardization of spindles for automatic looms, as well as the corresponding sizes of shuttles and of their component parts.

The difficulties of the present situation are nicely illustrated by a booklet which has been prepared to inform the German textile industry regarding standards for textile machinery. In large letters, the question is asked:

> "Do you buy your incandescent lamps by sample or from drawings?
> "No?
> "Then read this book on textile standardization. You do buy loom replacement parts that way."

As an example of the waste due to absence of standardization, 31 per cent of German shuttles are bought on such an uneconomical basis that only from one to twelve in a lot are alike, and lots of as many as 150 identical shuttles are purchased in only 15 per cent of the cases. Since there are from 35 to 50 machine operations used in the production of a shuttle, it is, under present conditions of ordering, practically impossible to produce this item economically. It is pointed out that where a standard exists, a line of print suffices to describe the product, whereas, without it, samples, or lengthy and elaborate drawings and descriptions must be sent.

[1] Formerly contributing editor of the ASA BULLETIN.

Other branches of industry, which have made greater progress in standardization, have been able to make great savings through such work. In a German shipyard the standardization work costs one one-thousandth part of the turnover, and the savings obtained thereby amount to 20 times this amount, or two per cent of the turnover. There seems no reason to doubt that similar savings could also be made in the textile industry, the textile machinery industry, and in the industry manufacturing spare parts and accessories.

(*A translation and digest of some important papers on standardization of textile machinery are available and may be borrowed from the ASA office.*)

The Importance of Applying Standards

The following editorial is reprinted from Machinery, London, December 24, 1931:

A great deal of work is being done today in all the important manufacturing countries of the world to formulate standards that are intended to be recognized internationally, nationally, or perhaps merely by the members of an association or institution. It is generally recognized, moreover, that standards, provided they are drawn up with due care, can prove of enormous assistance to industry and be the means of effecting substantial economies in production costs. At first sight, it may appear to be unnecessary to add that a great deal of the value of a standard is lost unless it finds wide application either in the country or section of industry for which it is intended. All too often, however, when a standard has been set up for which a need admittedly existed, individual engineers fail to avail themselves of it, thereby not only denying its benefits to their own firms, but doing much to nullify its advantages to those who have been sufficiently enterprising to accept it.

So lax indeed is the attitude of certain sections of the industrial communities in this country that we occasionally receive inquiries from quite well-known firms who appear to be unaware of the existence of our national standardizing body, or at least ignorant of the nature and scope of its work. At the same time, it is impossible to believe that these firms work without any standards at all, and this renders their careless attitude toward national standards the more difficult to understand. There is no doubt that the average engineer sometimes feels that the question of standardization has been overdone, and not altogether without justification, as any one will agree who has had occasion to investigate the apparently innumerable types of recognized screw threads. The British Standards Institution (formerly the British Engineering Standards Association) certainly cannot be accused of precipitate or ill-considered action in connection with the formulation of new or revised standards. Indeed, we once heard a well-known engineer express the view that the customary practice was to discuss the standardizing of a particular item for so long that by the time the standard was issued the component to which it related had passed out of general use.

This is, of course, an exaggeration, but it serves to convey an idea of the immense amount of thought and investigation which is expended on this work, and it behooves the British engineering industry to accord the Institution the fullest possible support in putting the results of its labors to practical use.

Booklet on Public Purchasing

A valuable booklet for any one concerned with the framing or revision of laws relating to public purchasing has been written by Dr. Russell Forbes and published by the National Association of Purchasing Agents, 11 Park Place, New York. Dr. Forbes is secretary of the National Municipal League, director of the Municipal Administration Service, consultant on governmental purchasing to the National Association of Purchasing Agents, and is associate professor of government of New York University.

The booklet, the title of which is *Purchasing Laws for State, County, and City Governments*, reviews the essentials of purchasing legislation and includes recommended state laws for state and county purchasing and recommended charter provisions and ordinances for city purchasing. Provision is included in these suggested laws for the use of standard specifications and for the organization of standardization committees to assist in the preparation and revision of specifications.

Canadian Representative Appointed on Sieves Committee

Mr. J. H. Parkin, assistant director of the Division of Physics, National Research Council, Ottawa, Ontario, has been appointed to act as liaison representative of the Canadian Engineering Standards Association on the sectional committee on Sieves for Testing Purposes (Z23) working under the procedure of ASA.

ASA PROJECTS

The Use of a Standard Color Scheme for the Identification of Piping Systems[1]

by

John Gaillard, *Mechanical Engineer*
American Standards Association

How the national standard for the identification of piping systems can be adapted to the requirements of individual plants

In a recent article,[2] the use of identification colors on pipes and conduits was advocated as a safety measure and as a means of facilitating maintenance of the piping and conduit system. This suggestion was made, according to the author's statement, "in the absence of a standard color scheme for the identification of pipes and conduits carrying the plant's various services." There exists, however, a national standard scheme for the identification of piping systems intended to serve as the general basis for color identification systems adopted by individual plants or branches of industry. This scheme was developed some years ago under the procedure of the American Standards Association and under the joint sponsorship of the National Safety Council and the American Society of Mechanical Engineers. It was approved by ASA as American Recommended Practice.[3]

Pipes are defined as conduits for the transport of gases, liquids, semi-liquids, or plastics, but not of solids carried in air or gas. Pipes buried in the ground, and electric conduits, are not included in this scheme.

The standard scheme is based on the general principle that the pipes of a specific system shall be color-marked so as to indicate, first of all, to which of five major classes of materials their contents belong. This marking also tells whether the material concerned is safe or unsafe. The five classes are listed below, together with their respective characteristic colors and letter symbols:

F—Fire protection material—Red
D—Dangerous material—Yellow
S—Safe material—Green
P—Protective material—Bright blue
V—Extra valuable material—Deep purple

The basic color may be applied over the entire length of the piping system, or in bands eight to ten inches wide placed at intervals throughout the piping system, preferably near valves and other important places. More detailed identification of the material carried by a system may be obtained either by adding color stripes at the edges of the main color band, or by stenciling letters, words, or figures on the main band. These additional stripes or stenciled marks should be decided upon by the individual plant concerned.

There are two main reasons why a general scheme of identification employing colors cannot be worked out to cover all materials carried by pipes in any plant. First, no sufficient variety of readily distinguishable colors is available to be applied to the large number of materials involved. Second, only a few pigments, when applied on piping, will stand up well enough under practical conditions of use and exposure to be considered as permanent. Moreover, most of the colors that do stand up are high priced and not always readily available.

It will be clear, however, that the main purpose—the securing of safety—is effectively attained wherever the standard scheme is applied. For example, if fire protection lines in all plants in this country were marked by the color red, so that all men working in such plants could become accustomed to this color indication, there would be practically no danger of a combustible or explosive liquid being erroneously directed upon a fire. However, such a fatal error might—or very probably would—happen if gasoline pipe lines were painted red, as suggested in the article referred to, and a workman or watchman, newly transferred from a plant that has adopted the Ameri-

[1] Reprinted from the December, 1931, issue of *Maintenance Engineering*.

[2] "Coded Pipes and Conduits Lessen Plant Hazards," by R. W. Spears, *Maintenance Engineering*, p. 236, May, 1931.

[3] Identification of Piping Systems (A13-1928). Copies may be obtained for 50 cents each from the American Standards Association.

can Standard scheme, were to attempt fighting a fire.

Classification of materials

The *fire protection* class includes the fluid in sprinkler systems and other fire fighting equipment.

Dangerous materials are defined as those that "are in themselves hazardous to life or property by virtue of being easily ignited, or productive of poisonous gases, or are in themselves poisonous. They include materials that are known ordinarily as fire producers and explosives."

Safe materials are "those which involve no hazard in their handling and which are of no extraordinarily high value. A workman in approaching a piping system to make repairs will accordingly run no undue risks in breaking into a pipe bearing a safe material, even though that material had not been emptied by previous arrangement."

Protective materials are those that "are piped through plants for the express purpose of being available to prevent or minimize the hazard of the dangerous materials above mentioned. Thus, a plant may have certain special gases which are antidotes to poisonous fumes piped through its shops for the express purpose of release in case of danger."

Extra valuable materials "might be classified with the group of the safe materials above mentioned, but where these products have a very high value, it is preferable to give them a separate major classification."

Choice of colors

Red has been chosen for fire protection equipment because of long-established custom. Yellow or orange has been assigned to dangerous materials because of the high visibility of each under poor conditions of illumination. Moreover, yellow as a color suggesting the exercise of caution is conventional in the quarantine flag of ships and in railroad signals. The three other colors have been chosen in the natural sequence of their appearance in the spectrum: green, blue, and purple.

Providing a company standard

The standard scheme gives specific instructions for its use as a basis for setting up a more detailed standard color scheme for an individual plant, as follows:

1. List all materials carried in the pipes of the system or systems.
2. Assign each of these materials to one of the five main classes referred to above.
3. Group the materials assigned to each class for the purpose of facilitating the selection of sub-class markings.
4. Choose between the alternative methods of using color bands or of painting the pipes completely in an identifying color.
5. Assign a legend or color stripe to each material listed under each main classification.
6. Refer to the list of colors for special applications (given in an appendix of the standard) and select the five color paints that will identify the main classes and the paints to be used for the stripes, if stripes have been decided upon.

Classification problems

Some materials have the peculiarity of being dangerous in one case and safe in another. For example, ammonia, usually a dangerous material, is a safe one when used for attacking phosgene fumes. Should its conduits be identified by yellow in the former case, and by green in the latter? Obviously, such variation in identification might lead to confusion. The committee which developed the standard therefore decided that the rule should be "once a dangerous material, always a dangerous material," and that in the exceptional cases where a usually dangerous material becomes a safe or protective one, special markings, other than color, should be used so to designate it.

There are also cases where a material that is usually safe becomes dangerous; for example, water over quicklime. According to the standard, the material should be classified as a safe one, but danger markings applied to the locations where it is dangerous. Similarly, it is recommended that fire outlets taken from a drinking or service water system be marked in red, but the remainder of the system in green (safe material).

Specific materials—The standard lists about 60 different materials carried in pipes, each with the class to which it belongs. Most of the materials belong to the "dangerous" class (acetylene gas, chlorine, mercury, steam above atmospheric pressure, and the like). Among the safe materials are carbon tetrachloride, cold soda ash solution, steam below atmospheric pressure, cold turpentine, and so on. As a valuable material, lactic acid is mentioned.

Trade standards—In order to show how the American Standard may be used as a basis for a more detailed standard applying to a specific plant or industry, a color scheme is given for

the identification of piping in paper and pulp mills. Water conduits are subdivided here into 15 kinds, some of which are designated simply by the green color for a safe material, while others are identified by additional color stripes, such as black stripes for boiler-feed water lines and return condensate water lines, and brown stripes for flow-off conduits.

Colored pigments—Fourteen colored pigments suitable for standard identification colors, and reasonably fast under changes in plant atmosphere, are listed in the standard. The resistance of each pigment against acidic, alkalinic, or sulphurated vapors or liquids is described. The list, which does not pretend to be exhaustive, is meant to serve as a guide in dealing with the more usual types of abnormal exposure conditions.

Legends—Detailed recommendations are given for the use of legends—stenciled letters or figures—on the main color bands. These legends should consist mainly of the name, perhaps abbreviated, of the material carried in the pipe line. An arrow may be added if the direction of the flow is important. Further recommendations concern the position of the legend, the size of its lettering, and the like, with a view to good visibility from the operating floor, platform, or balcony.

Standards Council Omits June Meeting

Omission of the regular June meeting of the ASA Standards Council has been decided upon by Cloyd M. Chapman, chairman of the Council. The items of business scheduled to come before the meeting will be handled by correspondence or postponed until the next meeting.

Action on the Electrical Fire and Safety Code (C3) is one of the items to be postponed until the next meeting. The Electrical Standards Committee has recommended that this project be dropped without prejudice from the list of official projects, it being understood that the state commissions and the casualty insurance groups are free to reinitiate some such proposal if they desire to do so after a careful study of the entire situation.

Approval of the report of the special committee on form and arrangement of published standards will be handled by correspondence.

The designation of nominating committees to present nominations for the offices of chairman and vice-chairman of the Standards Council for 1933 and to select Member-Bodies eligible to make nominations for approaching vacancies on the Board of Directors will be handled as they were in 1931, when the chairman of the Standards Council was authorized to appoint the nominating committees.

ASA Approves Standard on Gage Blanks

An American Standard on Plain and Thread Plug and Ring Gage Blanks (B47-1932) has been approved by the American Standards Association. This standard was developed by the American Gage Design Committee, under the chairmanship of Col. J. O. Johnson; Ordnance Department, U. S. Army. The Committee was formed in December, 1926, to consolidate independent efforts that had been made up to that time to simplify gaging practice through the adoption of standard designs for gage blanks and component parts. The work done by the American Gage Design Committee is complementary to that in course of development in the Sectional Committee on Allowances and Tolerances for Cylindrical Parts and Limit Gages (B4), which has been organized under ASA procedure to standardize tolerances and allowances for fits between cylindrical parts and the classification and establishment of tolerances for plain limit gages. (This committee set up an American Standard—B4a-1925—which is now being reviewed to ascertain whether it needs revision or supplementing.) The report of the American Gage Design Committee deals with details of the design of the different kinds of gages, such as the nominal dimensions of the gaging plugs and the handles into which they are inserted; while the problem of Committee B4 will be to establish manufacturing limits and permissible wear for the gaging plugs in question.

The American Gage Design Committee was not formally set up under the auspices of any particular organization, but consists of a representative group of manufacturers and users of gages. When the report of the committee which has now been approved as an American Standard was completed, it was first printed by the Bureau of Standards as Miscellaneous Publication No. 100, and thus placed at the disposal of American industry. After some time it was approved by the Bureau of Standards as a Commercial Standard, and recently it was submitted to ASA for approval as an American Standard.

The new standard contains technical information under the following heads: terminology; details of construction, comprising (1) plain cylindrical plug gage blanks and handles, (2) thread plug gage blanks and handles, (3) plain ring gage blanks, and (4) thread ring gage blanks; and taper plug and ring gages for checking taper lock handles and gaging members.

It is interesting to note that the Pratt and Whitney Company and the Taft Peirce Manufacturing Company relinquished their patent rights to the tri-lock plug gage design and a single-unit thread ring gage locking device, respectively, thus making it possible to incorporate these two designs into the recommendations of the committee.

Copies of the new standard may be obtained from the ASA office at 15 cents per copy.

New Safety Code for Floor and Wall Openings

The first national standard specifications for the construction of railings and toe boards have just been approved by the American Standards Association as a part of the Safety Code for Floor and Wall Openings, Railings, and Toe Boards (A12-1932). This standard was developed by a technical committee under the sponsorship of the National Safety Council.

This new safety code applies to all places where there is a hazard of persons or materials falling through floor or wall openings, or from stairways and runways.

The specifications for the construction of railings and toe boards are particularly important because of the reference which is made in other American Standard safety codes to these specifications. This new code applies to:

> "all places where there is a hazard of persons or materials falling through floor or wall openings and from stairways and runways. It applies to temporary or emergency conditions as well as permanent conditions. It does not apply to construction work to which the Construction Safety Code is applicable nor to private residences."

As causes of accidents, falls of persons and falling objects always stand very close to the top as major contributing causes and the application of the provisions of this new safety code will undoubtedly do much to eliminate the accident hazards which are causing such a large percentage of the total number of accidents occurring in all kinds of industrial establishments.

The seriousness of the various types of hazards which lead to accidents from falls may be judged from the fact that nearly 20,000 deaths result from falls in the United States each year. These include, of course, a large number of falls in homes and in other places where the provisions of the new code would not apply. Only one other cause of accidents—automobiles, causing an annual death rate of approximately 30,000—stands higher than falls in the list of fatalities from accidental causes. Figures compiled by the Metropolitan Life Insurance Company for 1930 show that of a total of 3479 fatal injuries outside the home, 930 were the result of falls. The record of falls is even worse in the home, where 1344 of a total of 3299 accidents were attributed to this cause. What percentage of deaths and injuries from falls can be eliminated through the enforcement of a safety code is problematic but some indication of the need for such a safety code is found in figures supplied by the New York State Department of Labor for a period of three years. These figures, published in the May, 1932, issue of *National Safety News*, show that of 54,678 compensated cases of falls 6928 were falls on stairs and steps; 1294 were falls from runways, balconies, and platforms; 574 were falls into floor openings; 60 were falls into manholes. From the point of view of fatalities, the record of this type of fall is worse. There were 69 deaths from falls on stairs and steps; 15 deaths from falls from runways, balconies, and platforms; and 30 deaths from falls into floor openings—a total of 114 deaths out of 8796 cases, as compared with 110 deaths from 27,058 compensated cases of falls on level surfaces.

The new safety code may be obtained from the American Standards Association at 20 cents per copy.

Revised Safety Code for Foundry Workers

The Safety Code for the Protection of Industrial Workers in Foundries (B8-1932) has been revised and approved by the American Standards Association as an American Standard. This code was developed by a technical committee under the sponsorship of the American Foundrymen's Association and the National Founders' Association.

The original safety code on this subject was approved in 1922 and the revision is based upon the experience gained from the application of the original code to conditions in foundries throughout the country. The revised code follows the general form of the original code except that an appendix has been added containing safety suggestions covering operating conditions which the committee felt would be helpful to foundry operators, foremen, and workmen.

Probably the outstanding feature of the code is the requirement which applies to charging buggies or cars (new equipment only) which calls for the use of small size automatic couplers. The committee has taken a decided step in advance in specifying this type of coupling

equipment in place of the old link and pin arrangement which has heretofore been predominately in use.

Copies of the new standard may be obtained from the American Standards Association at 20 cents each.

First Meeting of Noise Measurement Committee

A Sectional Committee on Acoustical Measurements and Terminology (Z24) under the procedure of the American Standards Association has been organized to deal with the problems of sound measurement. The chairman of the committee is Professor Vern O. Knudsen of the University of California and the secretary is J. W. McNair of the ASA staff.

At its first meeting on May 4, the committee considered the advisability of enlarging the scope recommended by the general conference on the subject held in January. The recommendation of the conference limited the work to noise measurement. After careful consideration it was decided to recommend to ASA that the scope be enlarged to include terminology, scales, and methods of measurement in the general field of acoustics as well as noise, since it was the general opinion that a much more satisfactory piece of standardization work could be accomplished if the broad field were included. The committee accordingly recommended to ASA the approval of the following revised scope:

> Preparation of standards of terminology, units, scales, and methods of measurement in the field of acoustics.

Two previously appointed technical subcommittees, one dealing with terminology and the other with noise measurement, are composed as follows:

Terminology

H. A. Frederick, Bell Telephone Laboratories, New York, *chairman*

Paul H. Bilhuber, assistant factory manager, Steinway & Sons, Long Island City, N. Y.

V. L. Chrisler, National Bureau of Standards, Washington, D. C.

C. W. Hewlett, General Electric Company, Schenectady, N. Y.

W. H. Martin, American Telephone and Telegraph Company, New York

R. V. Parsons, Johns-Manville Sales Corporation, New York

Irving Wolff, RCA-Victor Company, Camden, N. J.

Noise Measurement

Dr. Harvey Fletcher, Bell Telephone Laboratories, New York, *chairman*

V. L. Chrisler, National Bureau of Standards, Washington, D. C.

Professor F. A. Firestone, University of Michigan, Ann Arbor, Mich.

E. E. Free, New York

C. R. Hanna, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

H. B. Marvin, General Electric Company, Schenectady, N. Y.

R. G. McCurdy, American Telephone and Telegraph Company, New York

R. F. Norris, C. N. Burgess Laboratories, Madison, Wisc.

J. S. Parkinson, Johns-Manville Corporation, New York

J. C. Steinberg, Bell Telephone Laboratories, New York

W. Waterfall, secretary, Acoustical Society of America, Chicago, Ill.

S. K. Wolf, Electric Research Products Company, New York

Each of these subcommittees had held a meeting just prior to the meeting of the sectional committee and the chairmen reported in each case that work had been started.

In addition to the two subcommittees already appointed, it was decided to appoint two others, as soon as the enlarged scope should be approved, one on measurements of sound insulation and sound absorption and the other on fundamental sound measurements.

Silver Bay Industrial Institute

The third annual meeting of the Silver Bay Industrial Institute will be held at Silver Bay on Lake George, New York, July 8 to 22. There will be four separate divisions of the conference, the Plant Training Division, Supervisors Division, Personnel Division, and Smaller Plants Division. Standardization is one of the topics which will be discussed during the sessions of the Supervisors Division.

A folder describing the Institute may be obtained on request from the American Standards Association, which is one of the cooperating organizations.

Development of Specifications for Sieves in the United States[1]

by

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Bureau of Standards

ASA sectional committee will undertake development of sieve specifications in the United States; ISA suggests international specifications

Sieve specifications are of particular interest to industry. Many powdered or crushed materials are limited in their usefulness by their size as determined by a screening test. This subject is of particular interest at this time because of the formation of an American Standards Association technical committee to consider this question and also because of the proposal of the International Standards Association to consider the adoption of international specifications for sieves used for testing purposes. Plans for the organization and work of the committee are now well under way.

In this country the first specifications for sieves were for Numbers 100 and 200 sieves used in cement testing. Although these were designated in the specifications as Numbers 100 and 200 sieves, they were more commonly referred to as 100- and 200-mesh sieves. The variation in mesh of the cloth was specified and the nominal wire diameter, but not the tolerance in wire diameter. The specifications were indefinite in many particulars, and as a consequence the sieving results on one sieve were not necessarily comparable with those on another sieve supposedly conforming to the same specifications. The interpretation of the specifications by the Bureau of Standards was liberal, but up to November, 1911, no sieve had been tested which passed the 1904 specifications. Somewhat later a group of nine special sieves was made at the request of members of the American Society of Civil Engineers. These were made from imported cloth, which the makers claimed as being made to conform definitely to these specifications, and yet only five were found actually to conform.

In September, 1911, a group of Government engineers met in conference, considered the results of measurements of sieve cloth, and proposed new specifications including Numbers 20 and 30 sand sieves in addition to the Numbers 100 and 200 cement sieves.

The next development was the adoption of a sieving test for the Number 200 sieves. Owners of those Number 200 sieves which had been certified by the Bureau of Standards were sent standard samples of cement and asked to make sieving tests in accordance with instructions which accompanied the sample. Investigations were also carried out at this bureau, and as a result a sieving test was developed and incorporated in a revised specification for the standard Number 200 sieve, which was adopted by the Bureau of Standards on October 1, 1914.

Other industries recognize need for standard service

By 1914 other industries had recognized the need of standard sieves and the question of suitable specifications was referred to the Bureau of Standards by the executive committee of the American Society for Testing Materials. The subject was given a thorough study and a conference of representatives of various scientific and technical societies, Government bureaus, and firms was called for April 20, 1916. The conference selected as preferable a series of sieves having a ratio of $\sqrt{2} : 1$ between openings of successive sieves coarser than one millimeter, and a ratio of $\sqrt[4]{2} : 1$ between openings of successive sieves finer than one millimeter. The details of diameters of wires, tolerances, etc., were left to a committee appointed to consider these subjects.

The work of this committee resulted in the so-called "1916 screen scale." The committee recommended that the sieves be designated by their nominal openings. The final specification was based largely on the nominal catalog dimensions of sieve cloth then on the market.

With the entrance of this country into the War,

[1] Reprinted from the *Commercial Standards Monthly*, December, 1931.

[2] Secretary of the Sectional Committee on Sieves for Testing Purposes (Z23).

The author desires to acknowledge his use of a manuscript on the subject of sieve specifications by his former assistant, Mrs. M. M. Gardner, when preparing this article.

this question of sieve specifications was dropped until 1919, when the subject was again given a critical study. Amendments were then made to the previous specification, and the revised specification formally adopted in June, 1920, as the Bureau's standard, the series being designated as the U. S. Standard Sieve Series. These amendments consisted in making the sieve openings an exact geometric series with the ratio $\sqrt[4]{2} : 1$ used throughout the series regardless of existing sieves; in revising the wire diameters to give a regular increase in the ratio of wire diameter to opening throughout the series; in limiting the tolerances to percentage variations in the average sieve openings, the average wire diameter, and the maximum sieve opening; and in the elimination of the word "mesh" in the designation of the sieve. Up to that time the designations by "mesh" or "Number" were practically interchangeable, but since 1919 the sieves of the U. S. Standard Sieve Series have been designated by arbitrary numbers which approximate to a greater or less degree the mesh of the cloth.

Revisions in the tolerances were made in 1924, particularly in liberalizing the tolerance in the wire diameter, as it had been shown that if two sieves have the same size openings but different wire diameters the sieving results do not differ by measurable amounts. The same conclusions have been reached more recently by German investigators.

The same specification has been adopted by the American Society for Testing Materials but with the recommendation that the sieve be designated by the nominal opening expressed in microns.

This series of sieves is both theoretical and practical. It is theoretical in that it is based on nominal openings which progress in a ratio which is logical and reasonable; it is practical in that sieves are readily obtainable which conform to the specifications. Nearly 5000 sieves have been certified at this bureau as conforming with these specifications. The series is not restricted to one firm.

These specifications have been very generally accepted by scientific and technical societies in this country as well as by laboratories and testing organizations. The influence of these specifications may be very definitely traced in a number of sieve specifications of foreign countries.

Not everything has been done, even in this country, in the line of sieve standardization, and some of these further steps will undoubtedly be taken by the new committee of the American Standards Association. Among the questions to be discussed are the standardization of the sieve frame, the best designation of the sieves, and the preparation of specifications for perforated metal screens.

Scope of Project on Gas Appliances Broadened

A revision of the title and scope of the project Approval and Installation Requirements for Domestic Gas Burning Appliances (Z21), in order to include commercial as well as domestic gas burning appliances, has been approved by the American Standards Association.

The scope of the project, as revised, is as follows:

> Establishment of minimum or basic requirements for the installation, performance, safe operation, and substantial and durable construction for gas burning appliances; together with such laboratory methods of test as are necessary for determining compliance therewith.

In the revision, the word "domestic" has been dropped from the title of the project. The new title is "Approval and Installation Requirements for Gas Burning Appliances."

Work on the following 18 subdivisions of the project is now proceeding under the sponsorship of the American Gas Association:

Approval Requirements for Gas Ranges (Z21a–1932)

Approval Requirements for Gas Refrigerators (Z21b)

Requirements for Installation of Conversion Burners in House and Water Heating Appliances (Z21c)

Requirements for Accessories (Z21d)

Approval Requirements for Gas Water Heaters (Z21e)

Approval Requirements for Central Heating Gas Appliances (Z21f)

Approval Requirements for Industrial Gas Boilers (Z21g)

Approval Requirements for Flexible Gas Tubing (Z21h)

Approval Requirements for Hotel and Restaurant Ranges (Z21i)

Approval Requirements for Garage Heaters (Z21j)

Approval Requirements for Space Heaters (Z21k)

Approval Requirements for Clothes Dryers (Z21l)

Approval Requirements for Incinerators (Z21m)

Approval Requirements for Gas Heated Ironers (Z21n)

Approval Requirements for Hot Plates and Laundry Stoves (Z210)

Approval Requirements for House Piping and Appliance Installation (Z21p)

Listing Requirements for Draft Hoods (Z21q)

Listing Requirements for Gas Cocks (Z21r)

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Project on Clean Coal Approved by ASA

As the result of a recent letter ballot of the ASA Standards Council, the American Standards Association has approved the initiation of a project to develop specifications for clean bituminous coal (M26), with the American Institute of Mining and Metallurgical Engineers (Coal Division) as sponsor. This project, originally proposed by the A.I.M.E. in May, 1931, has been the subject of an extensive canvass of producing and consuming groups during the past year. Opinion has now crystallized into the view that, although the project is difficult, attempts should be made to harmonize the divergent interests affected by such a standard. For the present it is proposed that the work of the committee should be confined to groups located east of the Mississippi River. The scope has not been definitely decided upon as yet, but correspondence with interested organizations indicates that the following covers, in a general way, the purpose of this project:

> Specifications outlining allowable limits of inacceptable material in prepared bituminous coal, whether mechanically cleaned or not, in sizes coarser than 2 in., the purpose being to define clean coal and not to standardize screen sizes.

Clean bituminous coal is at present simply a name with no guide or limit to determine what is meant when the term is used by coal mine operators or dealers. Refuse—non-combustible materials such as slate, rock, and so forth—is inevitably present in all coal, but there are no generally accepted tolerances on the amounts of such materials that are permissible in a shipment of coal. The purchaser has no method by which to determine whether or not his preparation is satisfactory and the distributor or retailer cannot be assured of a supply of uniform character. Claims and counter-claims regarding the inacceptable material in bituminous coal are constantly occurring. Harmonizing the varying view-points is difficult, due to the lack of specifications. A standard will benefit both producer and consumer—the producer by furnishing a gage covering the purchase of equipment and the degree of preparation required to provide a satisfactory product; and the consumer through the assurance of receipt of uniform coal complying with accepted specifications.

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ESC Takes Action on Projects

The following actions were taken at the meeting of the Electrical Standards Committee on April 15:

It was unanimously voted to recommend to Standards Council that the project Electrical Fire and Safety Code (C3) be dropped from the list of projects before the American Standards Association.

The question of transferring sponsorship of the following projects from the American Institute of Electrical Engineers and the National Electrical Manufacturers Association to the Electrical Standards Committee was referred to the present sponsors for their consideration and recommendation:

Insulators for Electric Power Lines (C29)
Oil Circuit Breakers (C37)
Disconnecting and Horn Gap Switches (C38)
Electrical Measuring Instruments (C39)
Rotating Electrical Machinery (C50)
Instrument Transformers (C22-1925)
Recommendation for Operation of Transformers (C53)
Constant Current Transformers (C54)
Transformers, Induction Regulators, and Reactors (C57)

The question of the inclusion of radio projects under the jurisdiction of the Electrical Standards Committee, and of the representation of the radio interests on the Committee was referred back to the Committee on Scope for further consideration.

It was unanimously voted that a letter ballot, with recommendation for favorable action, be submitted to the Electrical Standards Committee on the following question:

> "Shall the American Society for Testing Materials be designated as sponsor for a new project under the title of Shellac, Synthetic Resins, and Other Similar Insulating Materials with the following scope:
> "Specifications and methods of test for lacs and synthetic resins and similar materials for electrical insulating purposes? (It is understood that the first phase of the work

will cover methods of test for natural lacs only.)"

The following proposed standards were approved by the Electrical Standards Committee as sponsor, and approval by the ASA Standards Council was recommended:

Definitions and General Standards for Wires and Cables (C8a) recommended for approval as American Standard

Specifications for Weatherproof (Weather Resisting) Wire and Cables (C8k1) recommended for approval as American Tentative Standard

Specifications for Heat Resisting Wires and Cables (C8k2) recommended for approval as American Tentative Standard

Approval as American Standard of Standard Vacuum Tube Base and Socket Dimensions (C16c) was recommended to the ASA Standards Council by the ESC acting in the capacity of a special committee.

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USNC Standardization Work Reorganized

Further steps in the consolidation, within the framework of the American Standards Association, of the standardization work of the United States National Committee of the International Electrotechnical Commission and the Electrical Standards Committee were taken on April 14 and 15 at meetings of these two organizations.

A considerable simplification of the technical organization responsible for standardization work under the procedure of the ESC and the USNC has taken place as a result of the consolidation activities. Heretofore, the technical work of the United States National Committee of the IEC has been in the hands of technical committees termed "advisors."

Under the new arrangement, the technical work formerly handled by the "advisors" of the USNC is allocated to appropriate sectional committees under the procedure of the American Standards Association, where such committees exist. The official spokesman of the USNC for each IEC project in international negotiations and contact work will now be called the "technical advisor." In nearly every case the chairman of the sectional committee serves as the "technical advisor" representing the USNC on the IEC committee.

Under the revised arrangement, the IEC projects, the corresponding sectional committees under ASA procedure to which the activities of the USNC committees have been assigned, and the names of the technical advisors of the USNC are as follows:

IEC Projects

Sectional Committee	*USNC Technical Advisor*
Nomenclature	
(*Committee on Scope to report further*)	C. O. Mailloux (Consulting Engineer, New York)—*Vocabulary* A. E. Kennelly (Harvard University, Cambridge, Mass.)—*Magnetic Units* H. Pender (Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pa.)—*Letter Symbols*
Dr. Mailloux is director of the international secretariat for this project.	
Rating of Electrical Machinery	
Rotating Electrical Machinery—(C50) Transformers (*new*)	A. E. Kennelly (Harvard University, Cambridge, Mass.)
Symbols	
(*Committee on Scope to report further*)	J. F. Meyer (Bureau of Standards, Washington, D. C.)
Hydraulic Turbines	
	E. C. Hutchinson (McGraw-Hill Publishing Company, New York)
E. C. Hutchinson is director of the international secretariat, and C. B. LePage is assistant director.	
Steam Turbines	
	F. R. Low (Passaic, N. J.)
F. R. Low is director of the international secretariat for this project, and C. B. LePage is assistant director.	
Lamp Holders and Bases	
Rolled Threads for Screw Shells of Electric Sockets and Lamp Bases (C44)	R. E. Myers (National Union Radio Corp., Newark, N. J.)
Aluminum	
Hard Drawn Aluminum Conductors (C11)	T. Varney (Aluminum, Ltd., New York)
Standard Voltages and Currents	
(ESC to assume jurisdiction for the coordination of this project, utilizing N.E.L.A.-N.E.M.A. committee for advice)	C. E. Skinner (Westinghouse Electric & Manufacturing Co., E. Pittsburgh)
Electric Traction Equipment	
Railway Motors (C35)	N. W. Storer (Westinghouse Electric & Manufacturing Co., E. Pittsburgh)

Insulating Oils	
(*Committee on Scope to report further*)	E. A. Snyder (Vacuum Oil Company, New York)
Rules and Regulations for Overhead Transmission Lines	
(*USNC advisors to be continued for the present*)	M. G. Lloyd (Chief, Section of Safety Standards, Bureau of Standards, Washington, D. C.)
Radio Communication	
Radio (C16)	A. N. Goldsmith (Vice-President and General Engineer, Radio Corporation of America, New York)
Electrical Measuring Instruments	
Code for Electricity Meters (C12) Electrical Measuring Instruments (C39) C12 Committee to be reconstituted	J. F. Meyer (Bureau of Standards, Washington, D. C.)
Rating of Rivers	
Rating of Rivers (A36)	N. C. Grover (Chief Hydraulic Engineer, Geological Survey, Washington, D. C.)

N. C. Grover is director of the international secretariat for this project.

Terminal Markings	
Terminal Markings (C6)	L. F. Adams (General Electric Company, Schenectady, N. Y.)
Switches and Oil Circuit Breakers	
Power Switchgear (*new*)	J. W. Upp (General Electric Company, Philadelphia, Pa.)
Internal Combustion Engines	
	F. Hodginson (Westinghouse Electric & Manufacturing Co., Philadelphia, Pa.)

F. Hodginson is director of the international secretariat and C. B. LePage is assistant director.

The secretarial work of the USNC has been transferred to members of the staff of the American Standards Association.

The officers of the United States National Committee are now:

Honorary President—C. O. Mailloux (Consulting Engineer, New York)

President—C. H. Sharp (Electrical Testing Laboratories, New York)

Vice President—H. S. Osborne (American Telephone and Telegraph Company, New York)

Vice President—Charles Rufus Harte (Construction Engineer, Connecticut Company New Haven, Conn.)

Honorary Secretary—A. E. Kennelly (Harvard University, Cambridge, Mass.)

Secretary—P. G. Agnew (Secretary, American Standards Association)

Assistant Secretary—J. W. McNair (Electrical Engineer, American Standards Association)

Foreign Standards Available from ASA

The following are new foreign standards available to Sustaining-Members for loan or purchase through the ASA office. They are available in the language of the country under which they are listed. In requesting copies of the standards it is necessary to list only the ASA serial numbers preceding the titles. Send either a post-card or a note containing only the name and address of the person wishing to receive the standards, and the numbers of the standards desired. The card or envelope should be addressed to the American Standards Association, 29 West 39th Street, New York.

ASA Serial Number	
	Belgium
154.	Flanged wedge gate valves, gas and water type
	Great Britain
155.	Black bolts and nuts, studs, lock nuts and washers (British Standard Whitworth)
156.	Braided cables with copper conductors for overhead transmission lines
157.	Cast iron spigot and socket drain pipes
158.	Cooker control units for use in 2-wire circuits of not more than 250 volts declared pressure
159.	Dimensions and properties of British standard channels and beams for structural purposes
160.	Cored solder, rosin filled
161.	Plain dead-soft copper strip, bars, and rods for the windings of electrical machines
162.	Soft solders
163.	Portable accumulators and secondary batteries (lead-acid type) including sizes up to 100 ampere-hours at the 10-hour rate
164.	Stationary accumulators (lead acid planté positive type) for general electrical purposes
165.	Terminals for electrical apparatus for railway signaling purposes
166.	Testing of the zinc coating on galvanized wires
167.	Voltages for new systems and installations